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## RESEARCH ARTICLE

# MUSCULOSKELETAL DISORDERS AND OTHER HEALTH HAZARDS DUE TO ELECTRONIC DEVICE USAGE

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### ABSTRACT

Excessive use of electronic gadgets like mobile devices and computer can cause health problems like neck pain and other musculoskeletal disorders. This paper reviews publications of last 15 years which are focused on pathophysiology of mobile and computer related musculoskeletal disorders and other health hazards. Suggestions regarding their prevention have also been put forth.

#### Key Words:

Neck Pain,  
Musculoskeletal Disorders,  
Hand held Devices, Ergonomics.

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## INTRODUCTION

There has been an enormous surge in the use of electronic devices all over the world with India ranking as the country with second highest number of mobile users in the world (Stalin *et al.*, 2016). Also the computers are widely used for personal, professional and occupational reasons. The extensive use of these devices has led to escalation in number of patients with various health problems like musculoskeletal disorders, eye and ear disorders and sleep disturbances. Chronic neck pain that ensues causes a burden on health care system as these patients are twice as likely to use the health care facilities as compared to other population (Green, 2008). Besides it can also cause many social, mental and behavioural or psychological changes in an individual (Toh, 2017).

**Pathophysiology of musculoskeletal disorders due to electronic devices:** The term 'CANS' has been used for these disorders. CANS is defined as "musculoskeletal complaints of arm, neck and/or shoulder not caused by acute trauma or by any systemic disease (Huisstede *et al.*, 2007)." The term "Computer related upper limb (ComRULM disorders)" has also been used for upper limb cumulative trauma in computer users (Ming, 2004).

**Computer related disorders:** The use of computers involves typing on key board, dragging the mouse and such repetitive forceful exertions, awkward positions and localized contact stress cause upper limb cumulative trauma by overloading neck, shoulder arm and hand muscle and joints. The use of mouse causes combination of symptoms involving wrist and shoulder. Jobs involving prolonged use of mouse may lead to median neuropathy.<sup>6</sup>The muscles in the forearm that control the movement of fingers may become irritated and soft tissues may become inflamed and swollen. The repetitive up and down movement of thumb while using the computer keyboard may affect the tendons of extensor pollicis brevis and abductor pollicis longus which may become inflamed and swollen causing pain along the back of the wrist on the thumb side. This is called as the De Quervains syndrome. Carpel tunnel syndrome may also occur in predisposed individuals as a result of cumulative trauma related to computer use especially in obese individuals (Ming, 2003). In this condition the irritated muscles, swollen tendons and soft tissues cause diminished intraneural blood flow and the pressure changes on the nerves lead to tingling numbness, weakness and decreased coordination and strength (Ming, 2003).

**Adolescents and computers:** The growth in spinal structure is rapid in this age group and thus exposure to flexed static postures may of increased significance. Children being exposed to computer related activities are an independent risk factor for adolescents using computers 4-5 hours per day (Green, 2008).

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### Musculoskeletal disorders due to Hand Held Devices

**(HHDs):** It has been estimated that 79% of population between 18-44 years have their cell phone with them all the time, with only 2 hours of waking time spent without the phone in their hand (Neupane, 2017). The use of mobile devices or HHDs is different from desktop or laptop computers due to their portability and control interaction via a touch screen surface rather than keyboard or mouse (Toh, 2017). Prolonged forceful, low amplitude and repetitive use of HHDs causes neck pain due to forward flexion while looking down at the screens of mobile devices and texting for long periods of time. A positive relationship is suggested between neck flexion and neck pain with an increased risk if flexion of 20° or more is kept for more than 70% of studying or working time (Fares *et al.*, 2017).

The weight put on the spine increases when flexing the head forward at varying degrees. In neutral position it weighs 4.54-5.44 kg and when bent forward increases to 12.25kg at 15° and 18.14kg at 30° and further more with increasing angles of flexion (Fares *et al.*, 2017). The frequent forward flexion also causes changes in the cervical spine, curvature, ligaments, tendons, musculature as well as bony segments leading to pain in neck and associated areas (Fares *et al.*, 2017). The term "Text neck syndrome" has also been used to describe the neck pain and damage sustained from looking down at the hand held devices too frequently and for too long (Neupane *et al.*, 2017). The condition if left untreated can lead to serious conditions like flattening of spinal curve, onset of early arthritis, spinal degenerative changes, disc compression, herniation, neuronal damage, gastrointestinal problems and loss of lung capacity.

Besides this, the prolonged, forceful, low amplitude and repetitive movements and sustained gripping with thumbs and fingers also cause discomfort in wrist and forearm. The use of tablet puts more stress on neck muscles as compared to desktop computer and there is higher stress on wrist with smartphone use as compared to an ordinary keyboard phone (Toh, 2017). Tendinosis of extensor pollicis longus, myofascial syndrome of adductor pollicis and extensor digitorum communis may be present in users of HHDs. There is relation between mobile design and anthropometry of users in causing discomfort and fatigue in hand, elbow and shoulder while using HHD (Sharan *et al.*, 2014). Text messaging affects the hand muscles by causing static loading, hazardous body postures and overuse of hand muscles. Additional factors include small spacing in the key board, increased static loading and end range motion of thumb during texting. "Nintendinitis", "Gamers's grip", "SMS thumb", "iPod finger", "Blackberry thumb" and "wiiinjury" are the terms used to describe these conditions (Sharan, 2014).

**Personal characteristics and physical environment in causing musculoskeletal discomfort:** The individual factors such as age, gender, obesity, hormonal balance and systemic diseases may play role in neck/shoulder pain. Individuals of age more than 30 are twice as likely to have neck pain. Age related changes like disc degeneration, sarcopenia and will reduce space between the vertebrae and cause decreased range of neck motion and increased pain. Some studies show association between being overweight and having neck pain (Ming, 2004).

**Effect of bad posture on pain mechanism:** Kyphotic sitting with head in forward position causes the muscles of spine to

work twice as hard resulting in pain (Ming *et al.*, 2004). Patients' emotional state, sociocultural and psychological state will also have effect on posture and prolonged and or intensive muscle tension may lead to painful tension myositis on ischemic basis. Close association between chronic neck pain and depression has been observed. Some authors suggest that chronic pain represents underlying depression while others suggest that chronic pain leads to depression (Ming, 2004). Thus high mental stress, greater job strain and less control over job and low supervisory support are risk factors for musculoskeletal disorders.

**Gender:** Female have twice the odds of having work related neck pain (Green 2008) and the higher prevalence of neck pain in them is possibly because of their smaller body size while the computer workstations and other devices are designed as per male anthropometry leading to greater biomechanical stress (Ming, 2004).

**Effect of exercise:** Being passive during leisure time was associated with an increased prevalence of neck pain, while physically active individuals have reduced chances of having these disorders.

**Other health hazards due to electronic devices:** As per the study by Al-Khlaiwi *et al.* (2004) mobile phone use besides causing the musculoskeletal disorders, may also cause fatigue, headache, dizziness, tension and sleep disturbances due to exposure to electromagnetic radiation. A study by Thomee *et al.* (2013) have reported that excessive usage of mobile may cause mental overload, feeling of never being free, guilt due to inability to answer all calls and messages, addiction and dependency. In a study related to doctors and nurses, Aggarwal (Aggarwal, 2013) has reported that besides causing musculoskeletal discomfort, mobile usage causes dry eyes, computer vision syndrome, anxiety, phobia and insomnia. A study by Stalin *et al.* (2016) in South India showed positive association of mobile usage with tinnitus, painful fingers, restlessness, earache, headache, neck pain, morning tiredness, fatigue, eye symptoms and sleep disturbances.

### Prevention of health hazards due to electronic devices

**Primary prevention:** This can be done by promoting ergonomic adjustments to work environments, improving posture and working habits. Ergonomic computer workstation designs should be promoted. These are designed to reduce neck flexion with appropriate screen height and chairs and availability of document stands. There should be provision of docking station and external keyboards for laptop users. Ergonomic counselling at workplace should be done. Correct ergonomic posture should be adopted in which thigh trunk angle should be more than 100° and screen should be 15° below the eye level (Ming, 2004). Safety officers should be appointed at workplaces (Green, 2008).

**Secondary prevention:** This should be done to identify individuals with known pathology like rheumatoid arthritis or osteoarthritis who are asymptomatic and apply intervention (Green, 2008). Tertiary prevention is directed at preventing disability who have symptomatic disease in an effort to prevent disease progression or to offer rehabilitation. Stretching of neck shoulders and endurance training of neck muscles has been shown to reduce pain and disability and so it should be promoted in predisposed individuals especially women. To

avoid wrist discomfort, one should avoid bending it excessively during use of mouse, hit the keys softly, minimize prolonged dragging of mouse etc. Micro breaks and avoiding static postures and repetitive stress activities is an important preventive step. Mental stress at work place can be reduced by promoting collective decision making, promoting worker's control over job environment and ensuring support from seniors (Green, 2008).

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